

Claims

1 1. A gas purification system comprising:
2 a reactor having a reactor volume and a reactor wall, the reactor wall
3 having an interior side and an exterior side, and defining a communicating
4 portal therebetween for a mixed gas flow;
5 a heat conduit within the reactor volume having a conduit wall, the
6 conduit wall having an interior side and an exterior side, and defining a channel
7 therethrough for passing a heated material through the reactor volume;
8 a reaction catalyst coating in contact with the exterior side of the
9 conduit wall;
10 a gas selective membrane within the reactor volume disposed between
11 the reactor wall and the conduit wall, said gas membrane in contact with the
12 mixed gas flow and selectively passing a constituent gas of the mixed gas flow
13 therethrough, such that a raffinate of the mixed gas flow is retained in contact
14 with said membrane;
15 an outlet channel for removing said raffinate from contact with said
16 selective membrane; and
17 a passageway for the removal of the constituent gas from the interior of
18 said reactor.

1 2. The gas purification system of claim 1 further comprising a
2 reactor heater.

1 3. The gas purification system of claim 1 further comprising a
2 combustion catalyst in contact with the interior side of said conduit wall.

1 4. The gas purification system of claim 1 wherein a gap space
2 exists between said reaction catalyst coating and said membrane.

1 5. The gas purification system of claim 3 wherein the gap space
2 ranges from 0.05 inch to 1.0 inch.

1 6. The gas purification system of claim 3 wherein the space
2 comprises a laminar flow disruptor.

1 7. The gas purification system of claim 6 wherein the flow
2 disruptor is selected from the group consisting of: packing, particulate, mesh
3 wire, wool, granule, pellet and fluidized catalyst.

1 8. The gas purification system of claim 1 further comprising a heat
2 transfer element in thermal contact with at least one object selected from the
3 group consisting of: said heat conduit and said membrane.

1 9. The gas purification system of claim 8 wherein the heat transfer
2 element is a fin.

1 10. The gas purification system of claim 9 wherein the fin is coated
2 with a reaction catalyst.

1 11. The gas purification system of claim 10 wherein the fin has a
2 gas communication aperture therethrough.

1 12. The gas purification system of claim 1 further comprising a
2 combustion catalyst on an exterior wall of a feed tube.

1 13. The gas purification system of claim 1 further comprising a flow
2 disruptor with said reactor selected from the group consisting of: a dimple, a
3 protrusion, packing, mesh wire, wool, granulate, pellet catalyst, fluidized
4 catalyst, a baffle and a curved membrane.

1 14. The gas purification system of claim 20 wherein said heater has
2 flowing therein a sweep gas.

1 15. The gas purification system of claim 1 further comprising feed
2 liquid compression means to convey the mixed gas flow through the portal into
3 said reactor.

1 16. The gas purification system of claim 1 further comprising a
2 plurality of said membrane.

1 17. The gas purification system of claim 1 wherein the membrane is
2 hydrogen selective and the constituent gas is hydrogen.

1 18. The gas purification system of claim 1 wherein the catalyst
2 coating comprises a methanol reforming catalyst.

1 19. The gas purification system of claim 1 wherein the catalyst
2 coating comprises an ammonia cracking catalyst.

1 20. A gas purification system comprising:
2 a reactor operating above room temperature having a reactor volume
3 and a reactor wall, the reactor wall having an interior side and an exterior side,
4 and defining a communicating portal therebetween for a mixed gas flow;

5 a gas selective membrane within the reactor volume, said gas
6 membrane in contact with the mixed gas flow and selectively passing a
7 constituent gas of the mixed gas flow therethrough, such that a raffinate of the
8 mixed gas flow is retained in contact with said membrane;

9 an outlet channel for removing said raffinate from contact with said
10 selective membrane;

11 a raffinate compressor disposed in fluid communication with said outlet
12 channel; and

13 a passageway for the removal of the constituent gas from the interior of
14 said reactor.

1 21. The gas purification system of claim 20 wherein the raffinate
2 compressor is a venturi.

1 22. The gas purification system of claim 20 further comprising a
2 fuel cell powered by the constituent gas.

1 23. The gas purification system of claim 20 wherein the passageway
2 is brazed to the feed conduit.

1 24. A gas purification system comprising:
2 a gas selective membrane within the reactor volume, said gas
3 membrane in contact with the mixed gas flow and selectively passing a
4 constituent gas of the mixed gas flow therethrough, whereby a raffinate of the
5 mixed gas flow is retained in contact with said membrane;
6 an outlet channel for removing said raffinate from contact with said
7 selective membrane; and
8 a passageway for the removal of the constituent gas from the interior of
9 said reactor.

1 25. The gas purification system of claim 20 having at least one
2 component coupled thereto, said component being selected from a group
3 consisting of: a raffinate burner, a mixed gas flow feed pump, a raffinate back
4 pressure controller, and an oxygen sensor.

1 26. A gas purification system comprising:
2 a reactor operating above room temperature having a reactor volume
3 and a reactor wall, the reactor wall having an interior side and an exterior side,
4 and defining a communicating portal therebetween for a mixed gas flow;
5 a first reaction catalyst and a second reaction catalyst within said
6 reactor volume;
7 a gas selective membrane within the reactor volume, said gas
8 membrane in contact with the mixed gas flow and selectively passing a
9 constituent gas of the mixed gas flow therethrough, such that a raffinate of the
10 mixed gas flow is retained in contact with said membrane;
11 an outlet channel for removing said raffinate from contact with said
12 selective membrane; and
13 a passageway for the removal of the constituent gas from the interior of
14 said reactor.

1 27. The gas purification system of claim 26 wherein the first
2 catalyst is a high temperature catalyst and the second catalyst is a low
3 temperature catalyst.

1 28. The gas purification system of claim 26 wherein the first and
2 second catalysts are differentially distributed along a temperature gradient
3 within said reactor.